Gas Journal

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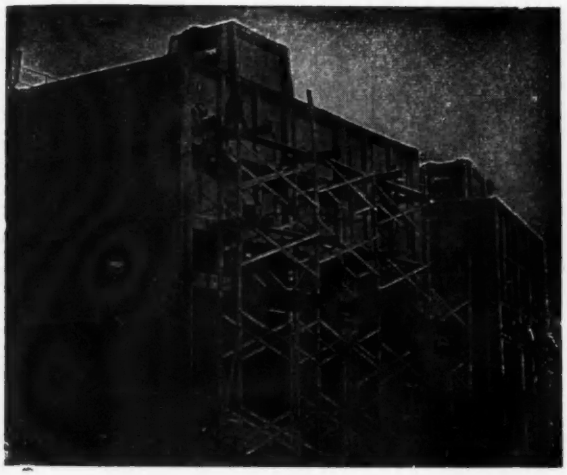

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Gas Journal

IIITH YEAR

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CONTENTS

EDITORIAL COMMENT

The Shape of Research - - - - - - - - 313
Converting the Architect - - - - - - - - 314

NEWS OF CURRENT EVENTS

Personal - - - - - - - - - - - - 315
Obituary - - - - - - - - - - - - 315
Diary - - - - - - - - - - - - 315
Coke Oven Managers Hear Steel Company Chief Talk of Favourable Factors - - - - - - - - 316
New Coke Handbook Details 400 Tested Appliances - - 316
B.G.S.A. Seek Redundancy Information - - - - 317
Improved South Western Tariffs Give Running Start to Campaign - - - - - - - - - - - 317
Axial Flow Compression: West Midlands Unit First to be Installed by British Gas Industry - - - - - 318

TECHNICAL RECORD

The Control of Atmospheric Pollution at Gasworks. By A. E. Haffner - - - - - - - - - - 320

Publishers' Notice, See Page 294, November 11, 1959

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the study of movement

So tremendously vigorous and difficult are the movements of Kathakli, dancers must first undergo years of intensive study and special massage in order to withstand the exhausting effect of performances lasting 16 hours.

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Gas Journal

VOLUME 300 No. 5020 NOVEMBER 18, 1959 111th YEAR

The Shape of Research

RESEARCH in the gas industry, as in every industry today, is becoming more and more important, and it was therefore with ever increasing interest that we looked at the programme of the 25th Annual Research Meeting of the Institution which opened at Church House, Westminster, yesterday.

This year the number of papers to be read will be 11, which does not include the reports from four Committees of the Institution and an address by Sir Harold Smith, Chairman of the Gas Council, on 'Research in the Gas Industry.'

The importance which the Institution attaches to research is shown by the great increase in the number of papers now read at these meetings every year and the general categories in which the subjects discussed may be said to fall. In fact, so great has the number become in the last three or four years, that it has become necessary to run parallel sessions on one day of the meeting. This particular arrangement has the advantage of encouraging the reading of papers of more widely differing subjects to different audiences which would not be sufficiently interested in each others' subject. Indeed, there is a double advantage in that by this means it is possible to get more papers read and more members to the meeting. Up till now the parallel sessions have been held on the second day, but this year they have been brought forward to the afternoon of the first day, presumably to allow those whose interests lie in the more specialist subjects to return home earlier.

In this year's programme the number of papers which the Gas Council's research stations are contributing amounts to six, leaving five contributed by the gas boards, the Houldsworth School of Applied Science of the University of Leeds, and the industry's contractors. Of these papers four are concerned with gas manufacture and distribution, the remainder being on utilisation and industrial gas, with one on the design of flue systems.

If we look back on the papers read in previous years, it is possible to trace an evolutionary process by which the pattern of the 1959 programme is seen to be slowly emerging. The first research meeting was held in 1929 and was the direct result of the President, Mr. C. S. Shapley's, initiative. Its programme consisted in discussing reports sent in by the committees of the Institution which had that year received its Royal Charter. Such a pattern continued until 1934 when other reports on problems and subjects of particular interest to the industry began to be presented by individuals. The next landmark came with the founding of the Gas Research Board in 1939 when its reports began to appear at the research meetings in the early 1940s.

During the war years these meetings were perforce somewhat shortened, but in 1946 there were distinct signs of renewed interest and by the first meeting after nationalisation in late November, 1949, six papers were read, two of which were contributed by the Gas Research Board. All six papers were concerned with gas manufacture in its many aspects. From the contractors came a paper on electrostatic detarring, the industry contributed papers on the design of continuous vertical retorts and the disposal of liquor, and the Gas Research Board papers on the catalytic synthesis of methane and the hardening of acids in purifiers. In 1950 gas manufacture and plant was still the dominant theme, but the Gas Research Board contributed a paper on combustion research in gas utilisation. At this meeting too a very important paper on the catalytic gasification of petroleum oils was read by Stanier and McKean of the South Eastern Gas Board. This was, of course, the first public announcement of what became in a remarkably short time the Segas process.

At the meeting in 1951, though gas manufacture and distribution were still the most important subjects discussed, a paper on industrial gas and another on utilisation were also included.

At the following two meetings continuity was somewhat disturbed by the Gas Council's decision to disband the Gas Research Board and set up in its place the two research stations at London and Solihull. As matters turned out advantages were gained by this move, but at the time there was, it seemed, a noticeable gap in contributions by the industry's technological research organisation and possibly valuable time was lost. Papers appeared at these two meetings which set out the lines on which research was to be planned. It was noticeable that at the 1951 meeting all three papers issued by the Gas Council and describing technical advances came from the North Thames and South Eastern

areas. Gas manufacture still predominated, though a paper on iron carbonyl in town gas was also included.

In 1953 there were distinct signs of a broadening of the subjects discussed and papers appeared on experiments connected with common balanced flues, and heat transfer and the cooking process. The following year gas manufacture by processes other than carbonisation was discussed in three papers and a paper was read on the French gas industry's research organisation; there were also two papers on gas utilisation.

In 1955, under Mr. W. K. Hutchison's presidency, the set-up we know today was begun and the two parallel session system instituted. As we have pointed out, such an arrangement has not only enabled the range of subjects to be broadened, but the specialists in the different branches of research which constitute the purely technical side of the industry may now hear papers of particular interest to them without the need to extend the duration of the meeting.

Compared with former years the programme in 1956 might have been sponsored by some other organisation. There were no papers on gas manufacture and distribution, but instead the joint sessions dealt with coal research and the hydrocarbon content of fuel gases, and the parallel sessions, generally speaking, with industrial gas and utilisation respectively. The following year the programme had become more orthodox again and one of the parallel sessions dealt with manufacture once more, but by unorthodox processes.

What conclusions are we to draw from this review of the subjects discussed over the years at the annual research meetings? That these meetings are of the utmost value goes without saying, but the diversity of subjects discussed points to the increasing complexity of our industry. Gas must not only be made at the lowest possible cost, stored and brought to the consumer at a price competitive with any other fuel, but it must also be burned efficiently and the appliances used must be applicable to modern buildings. Such problems will be more easily solved if more and more is known before the problem becomes serious. This is what well planned research on a broad front must do.

Converting the Architect

IT is now generally accepted that the gas industry must make an all-out effort to build a space heating and water heating load which will absorb the business gradually being relinquished by solid fuel. This is a market in which gas has very real advantages over electricity and oil and, fortunately, the industry has a first-rate range of appliances—indeed, the range continues to improve in variety and quality.

In view of this it is all the more alarming to find architects who are frankly amazed when a client expresses a preference for gas in a new house and who are clearly ignorant of the advances which have been made in recent years and of the competitive tariffs which have been adopted by most gas boards. We hope readers will not dispute the fact that this kind of reaction happens—indeed, is common—although there seems to be little doubt that the attitude of the architectural profession varies considerably in different parts of the country, depending on the extent to which gas boards are facing up to the problem of dispensing information at the right level and in the right way. It may not be an exaggeration to suggest that this is one of the most pressing needs of the industry today. Failure to convince builders and architects of the very real virtues of gas for house heating could have serious repercussions on the industry's future.

Fortunately certain boards are making a great effort to establish the necessary *rapport* with these influential middlemen, for such they are, links between the gas industry and a vital body of future consumers. By far the most effective method is the establishment of permanent exhibitions at which the virtues of gas appliances may be demonstrated and their installation explained. Architects, builders, heating engineers and selected consumers may be invited to the exhibition in order to help them visualise what an installation will look like in a house and to discuss costs, etc.

Last week the North Thames Gas Board opened such an exhibition in its area, at Regents Park Road, Finchley. Called a ' home heating advisory centre,' this excellently staged display embraces central heating boilers, warm air heaters, built-in refrigerators and drying cabinets, incinerators, flue systems and the very interesting Harton prefabricated plumbing and heating unit.

A month ago the East Midlands Gas Board opened its second ' new housing centre ' at Leicester; it already has one at Derby and more are planned. The exhibits are generally similar to those at the North Thames exhibition but a little more emphasis has been placed on contemporary décor and the exhibition includes a very eye-catching kitchen setting.

There is also a strong case for temporary exhibitions, a number of which have been held up and down the country; one of the most recent was that staged last month at Southampton which brought in a very worthwhile number of enquiries.

Such activities need a substantial amount of supporting advertising, publicity and technical information. Here again it is pleasant to be able to report that there is some excellent material about, although more is needed. The Gas Council, to our mind a little slow to lend its support to the central heating drive, has come up with a brochure and an absolutely splendid new full colour advertisement layout which emphasises the importance of introducing gas at the planning stage.

So far, however, we have not seen a technical handbook dealing with space heating by gas and designed for the use of architects and builders rather than ordinary householders. The closest approximation to this was probably one of the supplements which the Gas Council arranged for inclusion in a well-known architectural journal. This was an admirable idea, but we still think there is a need for something which combines plenty of essential information—flues, methods of installation, running costs, etc.—with a promotional presentation.

Personal

MR. J. R. S. FORSYTH, formerly divisional transport officer of the Central Division, Scottish Gas Board, at Perth, has been promoted Divisional Transport Superintendent of Glasgow and the Western Division. Mr. Forsyth, who is 43, joined the Scottish Gas Board three years ago to take over the Perth post, which was newly created. Previously he had been in the motor industry, both as a technical representative and in the retail trade, in Birmingham, Paisley and Perth.

MR. R. W. ROBERTSON, lately assistant works manager at Penrith (Cumberland) gasworks, has been promoted to Works Manager in succession to MR. S. SMITH, who has taken up a new appointment. Another member of the Penrith staff, MR. E. T. SYKES, has been appointed Assistant Works Manager.

MR. J. FIRTH has been appointed Manager of the mechanical handling Division of Robert Dempster & Sons Ltd., Elland, Yorkshire as from last week. Mr. Firth was formerly sales manager of the surface division of Richard Sutcliffe Ltd., Horbury, with whom he had been associated for 20 years.

MR. R. B. PAINTING, who was formerly with Parkinson Cowan, has joined the staff of the Midland Brass Fittings Co. Ltd. He will represent the company in the area of the Eastern, East Midlands, North Western and parts of the West Midlands Gas Boards.

MR. W. H. STATHAM, who has been appointed area Representative for Birlec Ltd., in South Wales, has his headquarters at Cardiff. Mr. Statham joined Birlec Ltd. in 1946 and prior to his new appointment was a sales engineer in the furnace division of the company.

MR. W. COMPTON CARR, having been recently elected as a Member of Parliament, has relinquished his position as managing director of Radiant-Heating Ltd., but will continue as a Director of that firm and of the parent company, George Wilson Gas Meters Ltd.

DR. A. REES JONES has been appointed a member of the parent board of Parkinson Cowan Ltd. He remains Director and General Manager of Parkinson Cowan Appliances Ltd., a division of the group.

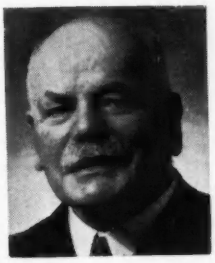
MR. W. R. GARRETT, Chief Constructional and Consultant Engineer with the Northern Gas Board, has been installed Chairman of the Institution of Structural Engineers (Northern Counties branch).

MR. J. W. MEREDITH, Managing Director of Huntington, Heberlein & Co. Ltd., a subsidiary of Simon-Carves Ltd., has been appointed a Director of the parent company.

Obituary

SIR FREDERICK J. WEST

SIR FREDERICK J. WEST, former chairman of West's Gas Improvement Co., Ltd., died at his home at Wilmslow (Cheshire) last Saturday. Sir Frederick was born at Maidstone (Kent) in 1872, the second son of Mr. John West, a pioneer in the application of mechanical handling in gasworks, who was then engineer to the Maidstone gas undertaking. Trained as an engineer, Sir Frederick's main interest was in the firm of West's Gas Improvement Co. Ltd., founded by his father at Maidstone in 1874 and subsequently established in Manchester in 1884. He succeeded his father as managing director and, finally, chairman of the company, which expanded rapidly into a world-wide organisation, contracting mainly for carbonising plant, but in some cases for whole gasworks. Still in the industrial field, Sir Frederick's activities widened out. He took a keen interest in the Institution of Gas Engineers, serving as president in 1941-42, and in the Society of British Gas Industries, of which he was chairman in 1910-11 and president in 1947-49.



Sir Frederick was elected a member of the Manchester City Council for his home ward of Newton Heath in 1905, becoming alderman in 1920 and lord mayor in 1924. During the 1914-18 war he played a leading part in organising the manufacture of armaments in the Manchester district, as a member of the Manchester Armaments Output Committee and as chairman of a combination of 28 firms engaged in the manufacture of military tanks.

Between the wars he went to occupied Germany as a member of the British Engineering Commission and served as a member of the Industrial Arbitration Court, a member of the Admiralty committee on the financial system of H.M. Dockyards, and a member, in 1928-30, of a committee set up to advise the Board of Education on technical education for the engineering industry. During the 1939-45 war he served as chairman of the North Western Area (Regional) Board; as vice-chairman of the North Western Regional Board of the Ministry of Production, and as a member of the Advisory Council to the same Ministry.

Sir Frederick was appointed C.B.E. in 1920, created Knight Bachelor in 1936 and Knight Commander of the Order of the British Empire in 1943, with promotion to Knight Grand Cross in 1947. His services to education in Manchester were rewarded by Manchester University, of which he served a term as member of the Court, by the conferment of the honorary degree of LL.D. in 1955.

MR. A. R. W. ROBERTS, who was for many years manager of Hereford gasworks, died recently. He was aged 66. Mr. Roberts joined the staff at the gasworks at the age of 21, in June, 1909, to begin his 37 years' service under the Hereford Corporation. In September, 1914, when the then manager of the works, Mr. C. B. Townsend, was killed in France, Mr. Roberts was appointed acting manager, and became engineer and manager in November, 1918. He retired at the end of December, 1946, owing to poor health. Mr. Roberts, who was a member of the Institution of Gas Engineers, joined the Midland Junior Gas Association at an early age, and the senior body in 1919. He was secretary to the association from 1929 to 1932, and in 1935 was installed as president of the Midland Association of Gas Engineers and Managers.

Diary

November 19.—INSTITUTION OF PLANT ENGINEERS, MERSEYSIDE & NORTH WALES BRANCH: Donnan Laboratories, Liverpool University. 'Developments in Welding Practice' by Dr. R. Weck, Director of Research, British Welding Research Association. 7 p.m.

November 20.—THE GAS INDUSTRY CHRISTIAN FELLOWSHIP: Livingstone Hall, The Broadway, Westminster, S.W.1. Inaugural Rally and First Annual Public Meeting. 7 p.m.

November 23.—WEST MIDLANDS G.C.C.: Gas Offices, Edmund Street, Birmingham. Council Meeting at 2.30 p.m.

November 24.—INSTITUTE OF FUEL, SCOTTISH SECTION: Royal College of Science and Technology, Glasgow. 'The Turbo Furnace' by G. Williams. 7. p.m.

November 24.—LONDON AND SOUTHERN JUNIORS. Visit to Lincoln Electric Company at Welwyn Garden City.

November 25.—I.G.E. LONDON AND SOUTHERN SECTION: Junior Institution of Engineers, Pepys House, 14 Rochester Row, Westminster, S.W.1. 'Influence of Frequency of Rotation of Oxide Purifiers' by R. J. S. Thompson of Messrs. W. C. Holmes & Co. Ltd. 2.40 p.m.

November 25.—INSTITUTE OF FUEL: Institution of Civil Engineers, Great George Streeet, London, S.W.1. The Melchett Lecture for 1959 on 'Surface: A Common Problem for Research and Engineering in Fuel Technology' by P. O. Rosin. 5.30 p.m.

November 26.—NORTH THAMES G.C.C.: City Hall, Westminster. Council Meeting.

November 26.—MIDLAND JUNIORS. Visit to High Duty Alloys Ltd., Redditch.

Coke oven managers hear Steel Company chief speak of some favourable factors

AT the Coke Oven Managers' Association's Annual Dinner in London last week, Sir Julian Pode, Managing Director of the Steel Company of Wales, referred to improved conditions in the steel industry and their effect on the demand for metallurgical coke.

He also spoke of the less fortunate conditions ruling in the coal industry, however, the other basic industry in which members were interested.

More economic

The National Coal Board's revised plan envisaged a production of some 200 to 215 mill. tons in 1965, with a reduced labour force and 80% of the coal coming from reconstructed and new collieries.

Coupled with reduced capital expenditure, this would make for a more economic cost and enable the industry to continue an economic supply of this quantity of coal out of the estimated 300 to 350 mill. tons coal equivalent of energy requirements estimated for the second half of the 1960s.

Effect of efficiency

With 65% to 70% of all coke oven coke used for blast furnaces, the reduction in pig iron manufactured during the recession had hit the N.C.B. and independent plants very hard, but perhaps the most serious effect on the demand for coke had been the increasing efficiency of blast furnace operation.

Larger furnaces, more intensive burden preparation, the use of sinter and oxygen enriched blast had, on average, reduced coke consumption per ton of pig iron made last year to 17.93 cwt. and by September this year to 16½ cwt.; in fact, many plants had a coke consumption under 14 cwt.

The increasing requirements of pig iron by the industry would however mean no further long-term reduction in the total tonnage of coke required.

In 1957 his company had made its highest annual tonnage of ignots—some 21¼ mill. tons—but in 1958 it had dropped to 19¼ mill. tons and this year it should be some 19.9 mill. tons.

The trade as a whole had been working below capacity, but shortages had been and were purely marginal and almost entirely confined to steel plates, the imports of which were 165,000 tons in 1957, 193,000 last year and 143,000 tons in the first eight months of this year.

A large strip mill plant installed and operating on such tonnages would not be economic.

In answer to the criticism that there had been no increase in sheet supply for some time, he pointed out that as far as his own company was concerned, the supply for the year ended September, 1959, had been 911,000 tons compared with 775,000 in 1958.

With the completion of his company's third development plan, by the middle of 1960 its ingot output target of 3 mill. tons should be reached and there should be a substantial increase in sheet supply.

Vast markets

With the threat of nationalisation removed and the continuing strength of the pound he was confident of the future. Given peaceful conditions, there were vast markets in underdeveloped countries, the standard of living of whose people must be raised. The coking industry had suffered a severe shake up in the last two years but things had settled down and most of the factors referred to must reflect favourably on the demand for coke, gas and the by-products from the carbonisation process.

Replying, the President, Mr. H. J. Victory, said he was most reassured by Sir Julian's views on the future of the steel industry and hoped that all the thought now being spent on education would ensure a supply of managers to keep the plants running in the future.

The guests

The toast to the guests was proposed by Dr. R. A. Mott, the Senior Vice-President and replied to jointly by Mr. E. M. Edwards, immediate past president of the Institution and Professor Sellars of University College, Swansea.

The Association's silver gilt medal, with 25 guineas given by Mr. G. W. Bradley, was presented to Mr. R. Middleton and Mr. D. Bradley.

Ten-ton chimney crashes

DURING the recent nationwide gales, a ten-ton metal chimney on top of the main building at Coleraine (Northern Ireland) gasworks was torn from its base to crash into a yard where, half an hour later, 30 men arrived for duty.

A chimney section penetrated one of the two gasholders and about 105,000 cu. ft. of gas escaped to atmosphere.

Despite the increased demands on gas because of electricity failures, the Gas Manager Mr. T. R. Cameron and his staff, managed to maintain pressure in the mains.

Damage at the works is estimated at some thousands of pounds.

NEW COKE HANDBOOK DETAILS 400 TESTED APPLIANCES

THE sixth edition of the Gas Council's Coke Burning Appliances Handbook has just been published—the first to be produced since the Ministry of Power invited the Gas Council and the National Coal Board to take over the approval of domestic solid fuel appliances last April.

The new handbook, which was introduced at a reception by Sir Henry Jones, Deputy Chairman of the Gas Council, has been produced by the Council's Coke Department.

It contains details of over 400 tested and approved solid fuel appliances—each with an information sheet giving technical data—and has been prepared in convenient loose-leaf form so that details of new models can be added as they are approved.

In his introductory speech, Sir Henry spoke of the extension of smoke control areas to all parts of the country which has increased the demand for reliable information on efficient coke-burning appliances for replacement purposes and new housing schemes.

He went on to say that coke would be very much better in future, and he stressed the importance of using the right type of coke for the appliance.

The majority of complaints received in connection with coke-burning appliances were due either to incorrect installation of the appliance or to the use of coke unsuitable for a particular appliance.

The handbook is obtainable from area gas boards and the Gas Council Coke Department, at the price of 35s., which covers the supply of supplementary information.

£2 mill. college extension at Loughborough

THE new £2 mill. extension programme started recently at the Loughborough College of Technology is 'one of the largest and most important projects in the Government's £160 mill. plan for technical education,' said Sir David Eccles, Minister of Education, in a message to Sir Edward Herbert, Chairman of the Governors of the College.

Office link-ups

B.G.S.A. SEEK INFORMATION ON 'REDUNDANCY'

ALARM about redundancy among the Aberdeen office staff of the Scottish Gas Board is the subject of a report by the Scottish organiser of the British Gas Staff Association.

The report says it is understood the Board's Northern and Central Divisions are to be amalgamated for the purposes of accountancy and other office procedure.

Punched cards

'We are advised,' the report states, 'that it is intended to set up a punched card installation at Perth which will deal with accounting and billing functions initially for both Divisions and which will necessitate the transfer of a considerable degree of work from the Aberdeen office.

'As this may give rise to the question of redundancy at some future date, it is hoped the Board will not delay in clarifying their intentions and the extent to which the amalgamation of the divisions will go, so as to allay the alarm which is already apparent among the Aberdeen staff.'

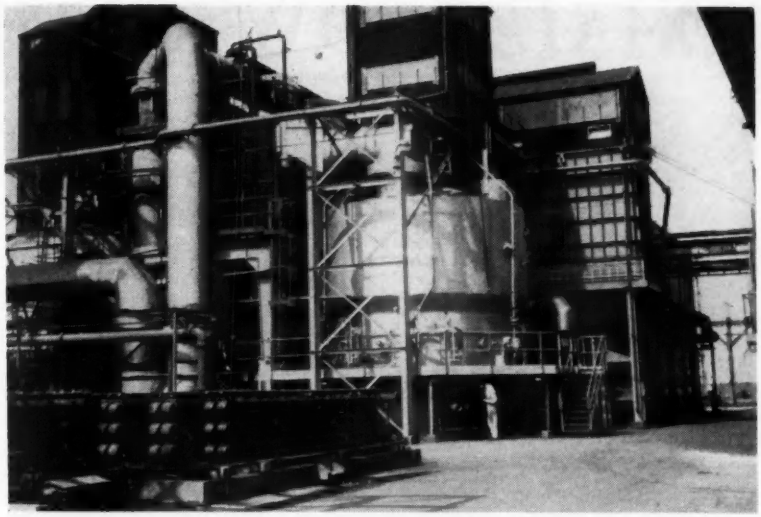
Mr. R. Owen, Service and Sales Manager of the Northern Division at Aberdeen, said that while it was known there was going to be an integration of the two Divisions, no information was as yet available as to what form this would take. It was premature to comment on how this would affect the staff. His personal view was that there was likely to be redeployment rather than redundancy of staff personnel.

Annual dance at Hull

Over 900 people attended the annual dance of the Hull District Sports, Social and Welfare Association of the North Eastern Gas Board, held in the City Hall, Hull, recently. Among the guests were Dr. R. S. Edwards, Chairman of the Board, and Mrs. Edwards, who presented the prizes, Mr. and Mrs. A. McDonald, Mr. A. Cole, Group General Manager, and Mrs. Cole.

A.H.E.M. FORMED

British hydraulic equipment manufacturers have now formed their own association, the Association of Hydraulic Equipment Manufacturers, with offices at 38/40 Eccleston Square, London, S.W.1.



Chemical Construction (G.B.) Ltd., and Dorr Oliver Ltd., have recently commissioned a plant producing SO_2 gas for sulphuric acid manufacture using by-product ferrous sulphate at the Grimsby Works of British Titan Products Co. Ltd. This plant decomposes dried ferrous sulphate with coal in fluidised bed roasters. It was designed and built by Chemico using Dorr Oliver Fluo solid reactors. The product SO_2 gas is converted to SO_3 for sulphuric acid production in one of the existing converters on the plants supplied by Chemico. The makers claim this to be the first ferrous sulphate decomposition plant in the U.K.

Improved South Western tariffs give running start to campaign

NEW tariffs for consumers in the South Western Gas Board's area were announced last week. They will become effective from meter readings on or next following December 10.

Outstanding features

Six outstanding features of the new tariffs are:

1. The running rate on the optional two-part tariff has been reduced by ½d. to 1s. 4d.

2. An additional optional economy tariff for domestic consumers has been introduced. This is particularly applicable to medium consumers, with a fixed quarterly charge and a running rate of 1s. 8d.

3. A 2s. flat rate has been introduced for certain non-domestic consumers.

4. Price area three has now been abolished, and has been merged with the lower price area two.

5. The quarterly standing charges of 5s. and 5s. 9d. have been abolished.

6. There will be a reduced differential between price areas.

Year's publicity

Publicity for the new tariffs was well-organised. An announcement taking the form of a two-page advertisement by the Board appeared in 11 daily papers in the South-West on November 10, and in all the weekly papers in the area during last week.

The announcement was a prelude to a large-scale publicity campaign, planned by the Board to operate over the next 12 months to popularise the new tariffs. Plans include direct mailing, window displays and an all-out drive to sell central and selective air heating systems.

Show bungalows are being erected in major showrooms incorporating selective air heating. A considerable proportion of the Board's publicity will be given to Gloco and Coke-nuts.

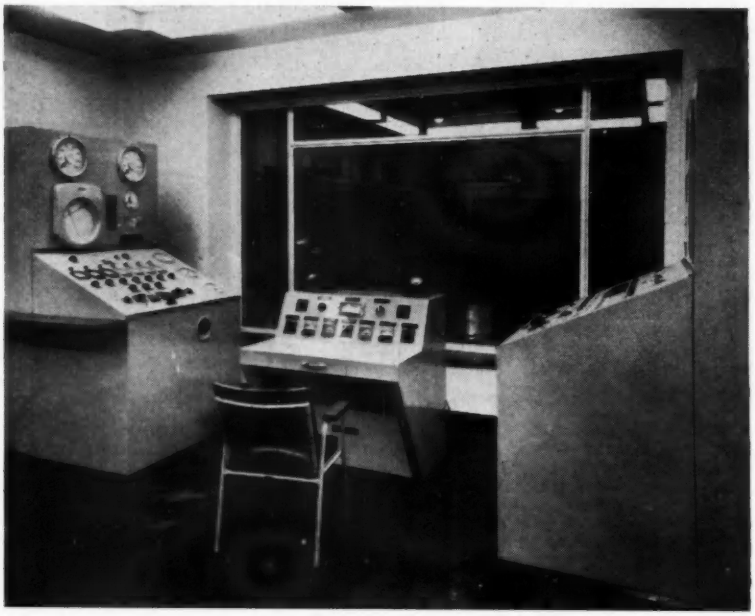
CARBONISATION PLANT SITE SEARCH

A LONDON firm, Hubbard & Fetterington Ltd., in conjunction with Mitchell Engineering Ltd., are inspecting sites adjoining the Douglas Castle pit in Lanarkshire which are suitable for a low temperature carbonisation plant.

The first phase of the operation, which would cost £100,000, will be a pilot plant to test the process. This would be followed by a £500,000 plant if the calculations made are confirmed. The plant would use cannel and other coals mined in Lanarkshire to make oil, gas, sulphate of ammonia and smokeless fuel. Prices, it is claimed, would enable coal products to match the cost of oil and gas from other sources.

It is also thought the process might be applied to peat.

AXIAL FLOW COMPRESSION



Centralised control room and operator's desk.

West Midlands unit is first to be installed by British gas industry

THE axial flow compressor lately installed at the Washford Heath holder station of the Birmingham Division of the West Midlands Gas Board is the first of its kind to be employed by the gas industry in this country. So far only one unit, with a capacity of 600,000 cu.ft. per hour at 25 p.s.i.g., has been commissioned but a second, exactly similar, unit should be working within the next three months. The aim is eventually to instal four compressor units, three of which will be in service with the other as a standby.

With the development of the motor industry at the south south western corner of the Division, a gas supply problem of some magnitude has been facing Birmingham distribution engineers.

Inadequate main

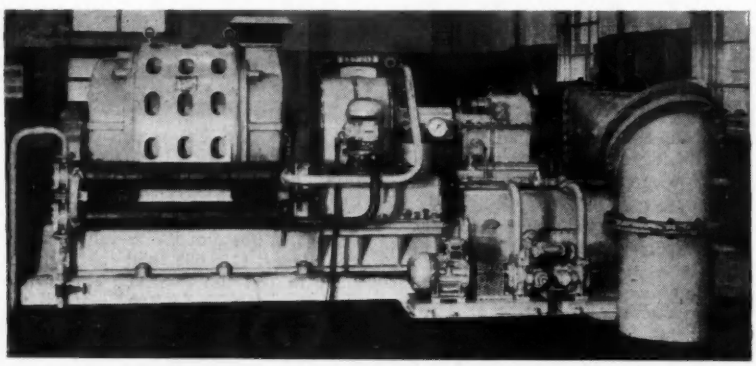
An existing high pressure main, capable of carrying a maximum volume of 1¼ mill. cu.ft. at 17 p.s.i. per hour from the Windsor Street gasworks, was proving inadequate and so it was decided to lay an additional main from the Washford Heath holder station to increase the hourly supply to a maximum of 2½ mill. cu.ft. per hour.

Gas at this station, which has a holder capacity of 20 mill. cu.ft., comes from the Nechells gasworks, which with the recently installed c.w.g. plants, now has a capacity of 50 mill. cu.ft. per day.

The new high pressure main extensions were completed in 1957. The characteristics of the supply system were such, it was considered, that it would be an advantage for the new compressors to run under baseload conditions as far as possible, with any deviations in demand taken up by the existing plant at Windsor Street.

Compression of such large quantities of gas could be met by a compressor of the axial flow type, was the decision. After careful consideration of the economics of conventional compressor plant, the axial flow type of compressor as developed by W. A. Allen, Sons & Co., Ltd., of Bedford, was found to be much smaller in size, more efficient, and of a considerably lower capital cost.

Each compressor unit consists of a squirrel cage electric motor of 1,150 h.p., a scoop-controlled fluid drive, an Allen-Stöckicht epicyclic gear box capable of increasing the axle speed from 3,000 r.p.m. to 19,000 r.p.m., and the axial flow compressor, all mounted in line on a fabricated base



A view of the compressor unit showing the motor on the left, the scoop-controlled fluid coupling, the epicyclic speed-increasing gear box and the inlet to the axial flow compressor itself. In the foreground to the right is the duplicate centrifugal pump for lubricating oil circulation, in the centre the pump for maintaining oil pressure to the fluid coupling, and on left the cooling system for this oil.

plate which also acts as a lubricating oil reservoir for the whole machine. The dimensions of the compressor itself are 30 in. long by 15 in. diameter while those of the whole unit are 16 ft. 11 in. long by 5 ft. wide.

The axial flow compressor has two basic components, a rotor and a stator equipped with specially - designed blades, twisted from root to tip to meet the gas at the correct angle at all radii. Each compression stage consists of one set of rotary and one set of stationary blades.

In the Birmingham units there are 14 stages, with one additional set of stationary blades at either end to guide the gas to the first set of rotating blades at the right angle and to act as a flow straightener at the outlet, respectively.

The clearance between the rotary and fixed blades for maximum efficiency must be as small as possible. In this particular case the minimum cold tip clearance is .015 in. and the minimum axial clearance between rows, .035 in.

Under no circumstances must this type of compressor be allowed to work under surge conditions under which the flow process through the blading is broken down by an unstable relationship occurring between the pressure and flow of the medium being compressed, i.e., when flow is low and pressure high.

Should this happen flow reversal may occur with severe blade vibration which may cause serious damage. Surge conditions are, therefore, avoided by preserving a stable pressure-flow relationship even when gas demand is falling. To do this the volume of gas compressed is kept constant, but a proportion is by-passed back to the inlet.

Automatic plant

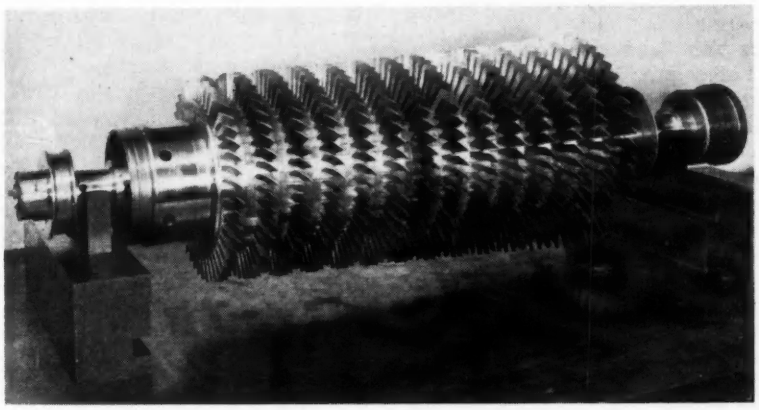
The plant works entirely automatically and is fitted with an electronically-operated speed control gear, a hydraulically-operated by-pass and finally an emergency by-pass valve which comes into operation should the other fail.

The speed control mechanism depends on the actual gas pressure deviation from a preset value causing a small electric current to flow which actuates the hydraulic mechanism of the scoop-controlled fluid drive.

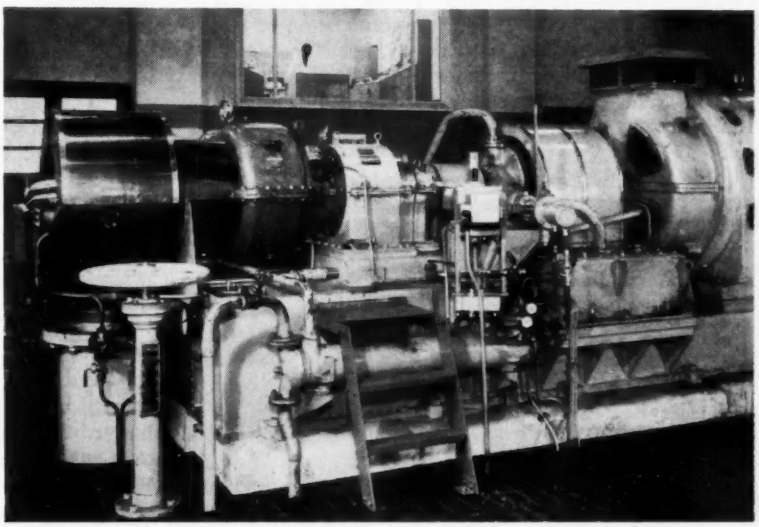
In this way, should surge conditions be approached, the speed of the compressor is locked; this device also makes its output more flexible. The by-pass valve is controlled hydraulically by the relative position of an oil nozzle which in turn is located by an impulse diaphragm, sensitive both to gas flow and gas pressure changes simultaneously. The emergency by-pass is operated by photo-electric cell unit.

All controls and instruments have been grouped together in a clean, well-appointed centralised control room. From here the operator on duty has a full view of the compressor plant, but is shielded from dirt and noise by a plate glass panel.

When the second unit is commissioned, both machines can be run in parallel capable of a design load of some 1.2 mill. cu.ft. per hour. At present the pressure will be maintained at 17 p.s.i.



The Allen axial flow compressor's rotor showing the 14 rows of blades. Their particular curved shape and the twist from root to tip is immediately apparent.



Another view of the Allen compressor unit. The compressor itself is seen towards the left of the photograph. It is immediately apparent how relatively small it is. In the middle foreground can be seen the electro-hydraulic gear for actuating the scoop-controlled fluid coupling. In the background the attendant on duty is seen at the desk in the adjoining control room.

From a paper to the London and Southern Section of the I.G.E., London, April 21.

The Control of Atmospheric Pollution at Gasworks

By A. E. HAFFNER, Ph.D., A.R.C.S., M.I.Chem.E., F.Inst.F., M.Inst.Gas E.,

CHIEF ENGINEER, SOUTHERN GAS BOARD.

THE type of carbonising plant has a very big influence upon grit, dust and smoke emission and it is interesting to trace in recent years the changing proportions of the different types of plant. Horizontal retorts from which there is the greatest difficulty in preventing smoke and dust emission, are becoming a smaller and smaller proportion. They are disappearing for economic reasons as well as for the difficulty of keeping this process clean and tidy. The continuous vertical retorts are a dominant proportion of carbonising plant and, as will be seen later, these do have a large measure of smokelessness.

The rate of installation of carbonising plant has been reduced because of the introduction of other processes based upon petroleum products. Nevertheless, intermittent vertical chambers are slightly increasing, coke ovens have been installed in recent years in two area boards and more coke oven gas is being purchased.

The sulphur balances for continuous vertical retort gas is shown in Table 1, but it is interesting to consider broadly the relative positions of the various gas-making processes.

Comparison with Power Station

The continuous vertical retort system quoted has a fuel consumption greater than more recent plant and sulphur emitted to atmosphere is correspondingly higher and its benzole plant is not designed for maximum sulphur recovery. The sulphur in combustion of coke and breeze sold has also been shown, but if the data is used to derive the lb. of sulphur emitted per mill. cu.ft. (5,000 therms) of gas, it must be remembered that 10,000 therms of coke and breeze have also been made.

TABLE 1
Basis—1 mill cu. ft. c.v.r. gas at 500 c.v.

	lb. of sulphur
Sulphur in. Coal 70 tons	2,352
Sulphur out.	
Coke to producers	224
Coke for sale	740
Breeze for sale	134
Ashes	16
Tar	92
Liquor	122
Spent oxide	994
Benzole	9
Purified gas	21
Total	2,352

TABLE 2

Gas-making plant	Sulphur in raw material lb.	Sulphur emitted by works lb.	Sulphur remaining in gas lb.	Sulphur in combustion of by-products lb.
C.V.R.	2,532	208	21	874
C.w.g. gas oil, coke oil	340 / 170 } 510	160	22	—
C.w.g. L.v.n. coke L.v.n.	224 / 10 } 234	160	16	—
C.w.g. refining gas, coke gas	111 / 468 } 579	107	18	—
Catalytic gasification				
Oil	1,330	832	36	—
L.v.n. ..	16	2	7	—

For the manufacture of 1 mill. cu. ft. per day of 500 B.t.u. gas.

It is of interest to compare the sulphur emission from a power station burning, as some modern ones do, oil fuel of up to 4.5% sulphur content, at 4,150 lb. per 5,000 therms or 3,100 lb. if credit is given for differences in efficiency of utilisation. This represents an extreme case since there are many power stations using oil and certainly coal of considerably less sulphur content.

In 1949 there were 1,050 works and now this has been reduced to about half. The smallest works are disappearing and these were often in congested neighbourhoods and caused a local nuisance. Increase in size brings new problems of atmospheric pollution by intensifying the source.

De-dusted Producer Gas

The improvement in efficiency of gas production by diminishing the fuel consumption per therm of finished gas causes a lower amount of waste gas to be emitted to atmosphere. Usually this waste gas now goes through a waste heat boiler designed to avoid the sulphuric acid dewpoint in the exit waste gases, but the cooling of waste gases, though contributing to the over-all economy of the process has diminished thermal uplift from the stacks. There is an increased tendency to use de-dusted producer gas for heating retort settings either generated in mechanical producers or in static producers now provided with more elaborate dust recovery systems. On the other hand, water gas plants are being operated at higher and higher blast pressures and this

has necessarily to be followed or accompanied by improvements in grit arresting before the waste gases finally leave the plant. There are some non-cyclic autothermic gas-making processes, such as the Maccormac peak load process, which are free from waste gases. Similarly butane-air mixtures, used at times of peak load to augment the gas output, are not associated with waste gas. These two processes are particularly valuable because they do not aggravate pollution at such times when there could well be smog conditions.

Oxygen gasification processes now being installed in Scotland and hydro-gasification process at Partington do not require any rejection of waste gases, but if any degree of carbon monoxide conversion is to take place the corresponding amount of carbon dioxide has to be discharged to atmosphere unless a commercial outlet is found for some of it.

Petroleum Products

More use is being made and will be made of petroleum products. Some of them are very low in sulphur and lend themselves to continuous catalytic reforming. One of the most interesting of these is liquid methane, *i.e.*, liquid natural gas. Refinery gas, some of it purified down to statutory limits of hydrogen sulphide, is being used to an increasing extent. Virgin naphtha or light petroleum feedstock or primary flash distillate is being used in water gas plants and in catalytic plants and benefits are to be derived from its low sulphur content. The Isle of Grain works depends entirely upon refinery products for its raw materials, and the only solid materials handled are the new oxide and spent oxide from the tower purifiers. Hydrogen production is being increasingly schemed to blend with high B.t.u. gas such as refinery gas and the gaseous effluents are CO_2 after CO conversion and waste gases from small oil fired preheaters.

Works are becoming more highly mechanised but there is an increased economy of steam usage by using low pressure steam derived from pass-out turbines for process purposes. More use is being made of purchased power with standby diesel alternators. This has reduced generally the steam raised on the works. Frequently it has been possible to shut down all direct fired boilers and to rely only upon waste heat boilers. The remaining direct fired boilers are based on smokeless fuel. Coal is no longer used on any gas works for steam raising, but the least saleable coke fraction, namely, breeze, is being used. This has associated with it a particularly difficult grit problem, but any breeze burning boilers, large or small, have built-in dust extractors. Peak load steam raising is often based upon tar or pitch creosote firing of low sulphur content.

Some area boards have taken advantage of National Industrial Fuel Efficiency Services steam and power surveys and this has frequently led to a reduction in direct fired steam besides improvements in the generation.

Just ten years ago Mr. John Wiseman,[1] gave a paper to the London and Southern Junior Gas Association on dust problems in gas works practice. In the last ten years, however, there have been some very important changes in legislation besides considerable reorganisation in the gas industry and new processes have appeared which were unsuspected then.

Let us now consider some of these problems. Logically we may begin with coal handling. Run-of-mine coal may contain 3.2% grit (76 to 700 microns) and 0.0% dust (below 76 microns), but the same coal if dried out contains 3.8% grit and 0.8% dust. Similar figures for nut coal are 2.0% grit and .1% dust as received and 2.5% grit and .5% dust if the coal dries out. In one maritime works, to prevent the greater dust evolution from run-of-mine coal, nut coal was adopted, but the rising price of graded coal makes this a matter which cannot be continued without economic review. It has been found expedient to enclose the coal stocking ground with 30-ft. high screens to prevent wind-blown dust reaching sensitive neighbouring industries. Expensive maintenance is needed on grabs to prevent spillage while in free transit from ship to shore. Grabs which traverse a long path such as in transporters or slewing cranes are more likely to spill coal, than grabs which discharge into an integral receiver at the foot of the jib with only a luffing motion and without slewing. Dumping grabs which open only on contact and therefore avoid dust evolution from the free fall of coal from an open grab on to the coal heap are an advantage but need more maintenance on grabs and hopper grids. Covered conveyors are better than open conveyor or aerial ropeway or road transport for dust on handling. Some existing open conveyors cannot be enclosed because the structure is not sufficiently sturdy to withstand the additional wind pressures which would result. It is considered that bulldozers and draglines are cleaner in operation than grabbing cranes. Spraying with water, particularly at times of drought, is practised, but so very often the coal is sufficiently wet because of the increased use of coal washeries. At coke ovens oil spraying is sometimes practised for other reasons, *i.e.*, to control bulk density, achieve uniform quality of coke and increase the gas yield, but it also reduces the amount of dust evolved. Atmospheric pollution can arise from coal stocking heaps if spontaneous combustion is started, but this is unlikely in stocks of nut coal where there is sufficient free space for self ventilation and cooling, but in run-of-mine coal the possibility of spontaneous combustion is nowadays avoided by the wide-spread practice of consolidation in 3 ft. layers during stocking by means of heavy bulldozers. Wagon tipplers represent a problem in dust control and measures adopted include enclosure up to a practicable limit and water spraying.

Very Great Disadvantage

Coal breaking plants provide a very difficult problem but by effective enclosure the dust can be contained within the building. No case has been met where this had led to explosive mixtures being fired off, but there is the very great disadvantage that maintenance and repairs of the breakers is likely to be neglected while it is unpleasant, even when the breakers are not at work, to enter into this dusty chamber.

At each transfer junction in conveyors there is always a problem of dust being raised, but this can be minimised by careful attention to design detail.

When charging coal into retorts, chambers and ovens, the most difficult and challenging problems are encountered.

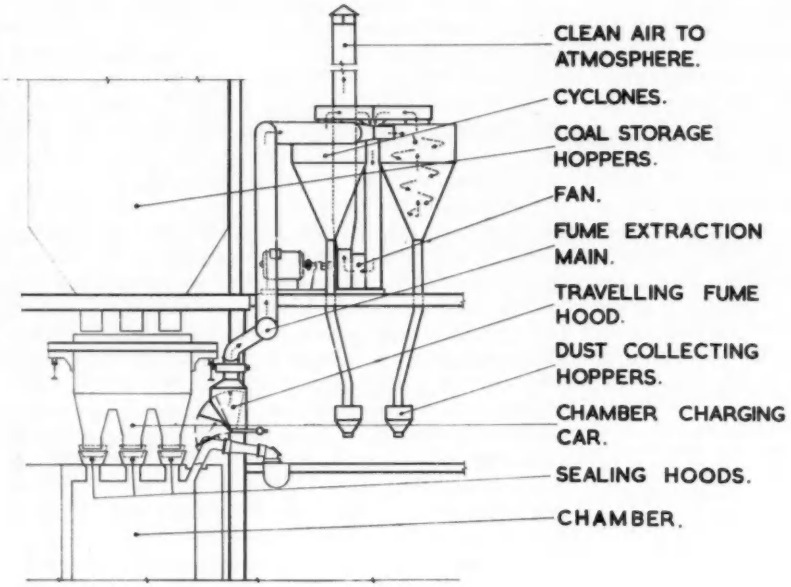


Fig. 1. A system installed at Kingston, I.O.W., of reducing atmospheric pollution when charging a battery of intermittent vertical retorts.

The gravity charging of intermittent vertical chambers from the coal car involves the descent of perhaps 3 tons of coal on to a breeze pad on the bottom door. The falling material causes a rising current of displaced air and in addition the fine coal dust descending with the charge begins to carbonise and some gas is evolved. This rising mixture creates a cloud of smoke and dust which can be controlled by applying increased suction on the main: This tends to increase the inerts in the gas and to foul tar mains and tar wells with sludge. This difficulty can be met by providing a duplicate circulating system to enable cleaning to take place whenever one system becomes fouled. Another way is to charge with as perfect an enclosure as can be practically devised between the chamber and the charging car and connecting this enclosure to the fan via a cyclone grit catcher. Fig. 1 shows the installation recently installed at the Kingston works, Isle of Wight, and about .26 lb. of dust and grit are collected for each ton of coal charged. The finer particles are not extracted and they go forward and are discharged to atmosphere. This remaining defect could be overcome by putting the withdrawn gases through a wet washer or by discharging from the fan into the waste gas main where there would be sufficient free oxygen to complete the combustion. This, however, would cause a variation in the 'pull' on the heating system and could be unacceptable on that account.

C.V.R. Entirely Satisfactory

In continuous vertical retorts coal from the hoppers passes through the coal valve into the coal box where there is sufficient coal for gravity charging for the next one or two hours. There is no air displacement and therefore there is no dust evolution and gas release. The continuous vertical retort is entirely satisfactory in this matter of coal charging.

The problem of the gravity charging of coke ovens is similar to that of intermittent vertical chambers. Double collecting systems improve the effectiveness of the pull across the entire length of the oven. The pull is augmented during the charging by steam jets in the offtaker. All the batteries of coke ovens in the gas industry include these two features to reduce smoke emission. Tightness of the oven doors is regarded as important for the double reason of improving the gas yield and diminishing pollution.

Dust and Smoke Problem

In the retort, chamber or oven itself the coke is a monolith fairly free of dust. It is a fissured monolith ready to break by splitting along these fissures. This breakdown begins on emerging from the retort be it falling away from horizontal retort, entering the extractor of the continuous vertical retort, or being pushed out by the coke oven ram. There is not only a dust problem here but also a smoke problem: For depending on the decision to retain some volatile matter in the coke partly to improve its combustibility, partly out of a compromise about the economic optimum throughput, some gas is still being evolved on discharge. Uneven carbonisation accentuates this effect, particularly in the case of horizontal retorts where through too long a charge the ends are inadequately heated and the volatile matter left in them is excessive. The intermittent vertical chambers discharge into hot skips which fit the bottom of the chamber close enough to avoid some of the nuisance, but smoke is still being evolved *en route* to the quenching tower when dust becomes entrained in the rising plume of steam. In one form of intermittent vertical chambers, namely the static vertical retort, the coke is discharged cool.

Continuous vertical retorts discharge coke into the extractor where cooling takes place by water and/or steam spraying. This is primarily to cool the extractor, but it is also a method of control of calorific value by blue water gas production. Although the coke collecting in coke box is cool it is exceedingly dry and on

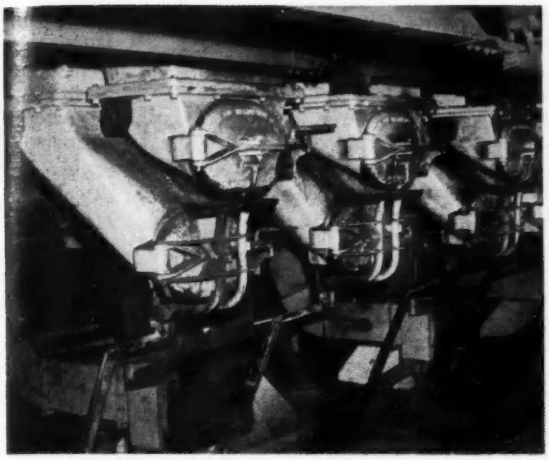


Fig. 2. A means of applying suction to avoid dust pollution on coke discharge. The contacts between the suction duct and the bogey can be seen.

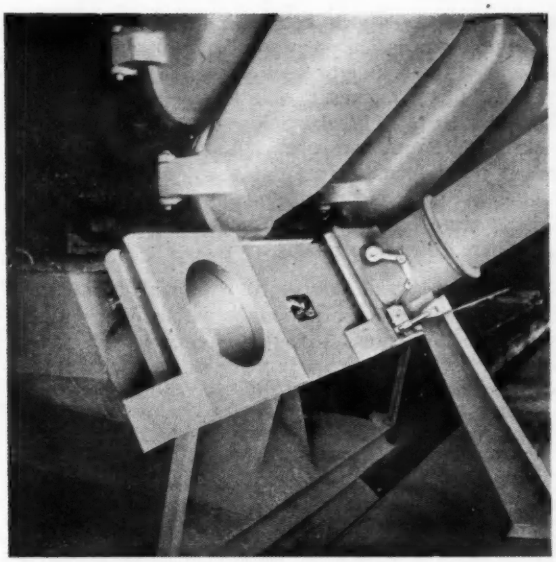


Fig. 3. The Drummond dust extractor system by which the suction is connected to the top of the bogey to draw away dust on coke discharge. The operating valve is seen on the suction pipe on right.

periodic discharge from the coke box into the coke skip there is an evolution of dry dust which is troublesome to the operator. Some coke extractors are water sealed and the water necessary to maintain the seal does suppress some of the dust and this basic need of merely adding water to maintain the seal has been developed further by developing elaborate spraying systems and drainage systems which have given some satisfaction in dust suppression (Fig. 2).

Another method to control dust is by applying suction to the coke skip (Fig. 3) and the dust is entrained in the air stream and the air stream is cleaned through a dry cyclone or through a water sealed box (Drummond system) before discharge to atmosphere (Fig. 4). It is on record that 4½ lb. (dry) of material per ton of coke is collected in this way and the final dust is in a wetted sludge form (more than 50% water), which avoids secondary dust difficulties on re-handling. Both methods are costly in capital or maintenance, but the difference between being and not being in operation clearly demonstrates the improvement in the working conditions. Like the intermittent vertical retort, the coke ovens have to have their coke transferred to the quenching tower, thence to be discharged cool and drained.

By whatever method the coke has been produced it is common to all systems that coke screening is necessary. The agitation of the coke during screening operations causes dust to be released by impact and abrasion. It would be a relatively simple matter to enclose a number of these more chronic points of dust evolution such as junctions and the screens themselves, but there is always the great difficulty that maintenance is hindered by enclosure. Even after screening into separate fractions more dust can be created by the free fall of the

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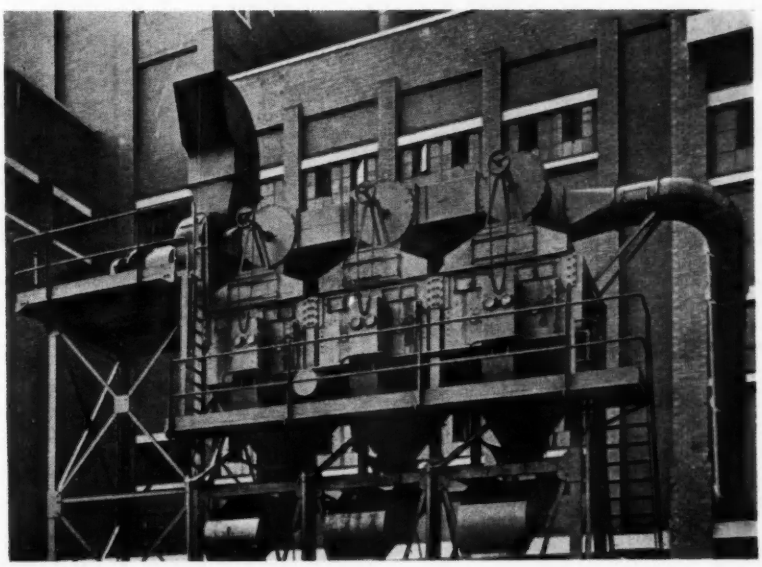
Fig. 4. A battery of Drummond Ansler filters erected outside the retort house. The dust is caught in the hoppers which are emptied into road vehicles when full.



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coke into deep hoppers below. This has been reduced in a number of instances by spiral chutes which ease the descent of the coke into the hoppers. The main object of doing this is to preserve the screened size and avoid some further (1%) breakage down to breeze, but it does help in dust suppression as well. Some ancillary processes in handling coke are those of de-shaling by pneumatic processes and the dust laden air resulting from this is removed from the enclosed screening tables and filtered off in cloth bags.

The dusty operations of coke screening and coke cutting are obviously best done in an enclosed building and there can be further degrees of enclosure by having selected portions such as primary screens within their own enclosure but viewed by the operator through glazed partitions.

Although spiral chutes reduce coke breakage on descending into hoppers, fines and dust are produced in any case due to the abrasions set up on emptying the hoppers. Particularly with dry continuous vertical retorts, coke dust can be troublesome at the outlet of hoppers at the final debreezing screens. Fine debreezing screens tend to clog, but there has been some experience with heated screens. In one case this dust was suppressed by directing jets of wet steam towards the screen. This would be wasteful in steam if it were not operated by the same lever which controls the debreezing screen. Judicious use of fine water spraying during coke handling can help to reduce dust problems. Stocking of coke and its reclamation produces other dust problems. Obviously minimum handling and re-handling is necessary and excessive free fall from grates is to be avoided. The great difference in content of free grit and dust in coke—and other gas works materials—between the normally wetted material and the material after drying is indicated in Table 3, and suggests that primary screening should be as dry as possible, but thereafter coke should not be allowed to dry out so as to release its dust.

TABLE 3

Free grit and dust in wet and dry material—Grit (76—700 microns), dust (below 76 microns).

	Wet			Dry	
	Water %	Grit %	Dust %	Grit %	Dust %
Coal	2·8	1·26	0·48	1·40	0·50
	2·6	1·58	0·37	1·54	0·62
	4·0	1·84	0·40	2·38	0·82
	6·2	6·33	0·00	8·51	2·08
No. 2 coke ..	2·7	0·26	0·09	0·63	0·09
	8·0	0·50	0·15	2·06	0·47
No. 3 coke ..	3·4	0·52	0·10	0·85	0·32
	4·9	0·34	0·09	0·76	0·39
Breeze	9·5	11·55	0·00	16·51	3·38
	9·9	3·48	0·00	6·49	1·64
C.W.G. Ash ..	8·2	0·06	0·00	1·96	0·43
	10·6	0·79	0·00	7·84	2·16
Producer ash ..	13·9	2·11	0·00	11·24	3·46
(step grate)					
,, ,,	10·1	3·20	0·00	11·86	3·56
,, ,, (mechanical)	10·5	2·08	0·00	6·77	3·03

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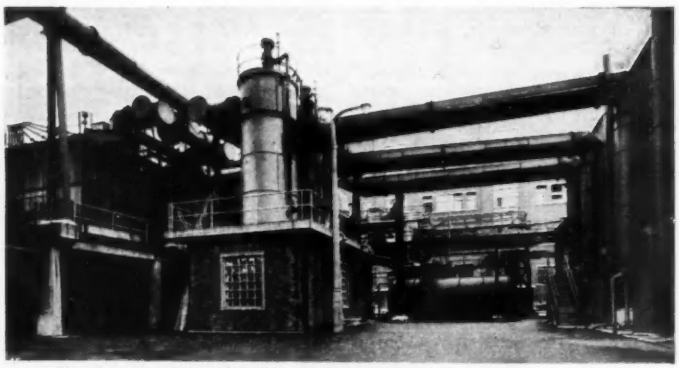

The riveted steel mains shown in the illustration were erected by us at Bromley-by-Bow Gasworks.

Photograph by courtesy of the North Thames Gas Board.

SAML. CUTLER & SONS LTD.

70 VICTORIA STREET WESTMINSTER, S.W.1

PROVIDENCE IRON WORKS MILLWALL, E.14

During periods of drought spraying with water or even calcium chloride solution can be effective to avoid dust nuisances in the works and in the customer's cellar. Coke should have been subject to final debreezing at the outlet to the hoppers or on reclaiming from stock on the ground since this is the last opportunity to improve the coke before delivery and prevent dust and breeze problems on the customer's premises.

There has been some experience in the gas industry of spraying coke with solutions of calcium chloride because of its hygroscopic nature and because it attracts moisture which continues the dust suppression effect. There is a disadvantage in calcium chloride in its corrosive nature and its effect upon coke bunkers, coke hods and possibly on the clinkering of certain ashes. The dustiest coke is that derived from continuous vertical retorts and although a large measure of cooling takes place in the coke extractor the coke is discharged still warm enough to evaporate most of the water imparted to it. Drying out releases the dust held by capillary attraction to the coke surface. If water with surface-active agents added to it is sprayed on coke while still warm, much of the effect of dust suppression is lost because of evaporation. The first real opportunity of applying surface-active agents is on de-breezing at the outlet to the coke hoppers.

Dr. J. G. King[3] reviews these techniques of dust prevention in the handling of coal and coke and makes the suggestion of the addition of various oils, waxes, polymers or waste resins which can be emulsified in oil or water and of small amounts of rubber emulsified in spindle oil. Dust does arise when the water content of this is of the order of 3%. About ½ gal. of light fuel oil per ton of coke would prevent dust production, but even this amount is noticeable when coke is burnt on an open fire, presumably because it causes smokiness. Comparative tests have been done upon the combustion performance and ignitibility of coke sprayed with oil in this manner against unsprayed coke. It was found that while sprayed coke is free from loose dust, it took a little longer to ignite, it did not reach the same level of radiation, it was somewhat smoky on refuelling and there was an unpleasant odour.

The earliest water gas plants were operated under such gentle blast conditions that the waste gases emerged from the stack at low velocities and the carry over of grit and dust was very small indeed. It was not until blast pressures were increased that it became desirable to install grit arrestors of the Centriflovane type illustrated (Fig. 5a). Basically it cannot hope to eliminate much finer material than grit, that is above 74 microns, because at one stage in the separation the curtain of separated grits falls vertically into a cone, through which the emerging gases have to pass and obviously carry with them the finer particles. In the last decade there has been some experience of the two-stage cyclone grit arrestor of the Howden type (Fig. 5c.) and this has the reputation of having a higher efficiency.

The performance of the Howden grit arrestor installed in 1952 at Sydenham on a 2½ mill. cu.ft. per day water gas set has been reported.[4] It was shown that the dust collected per hour amounted to 17.75 lb. whereas that carried off in the exit gases was 3.77 lb. This is equivalent to an efficiency of removal of 83%. In the course of a day's operation nearly 4 cwt. of dust were collected and about 90 lb. were discharged to atmosphere. At this rate the emission of dust in the clean gas is .086 grains per cu.ft. at N.T.P. of which .075 grains are about 20 microns in size. It is interesting to compare this with the recommendation before the Electricity Commissions that power station chimney

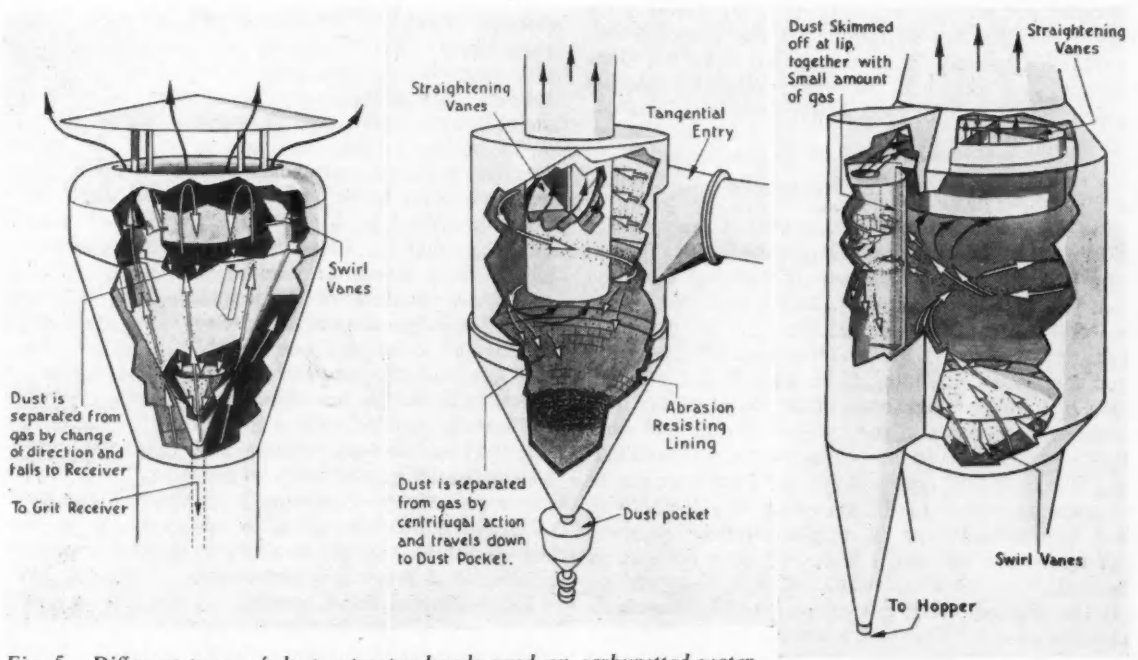
Swirl Vanes
Dust is separated from gas by change of direction and falls to Receiver
To Grit Receiver
Straightening Vanes
Tangential Entry
Abrasion Resisting Lining
Dust is separated from gas by centrifugal action and travels down to Dust Pocket.
Dust pocket
Dust Skimmed off at lip together with Small amount of gas
Straightening Vanes
Swirl Vanes
To Hopper

Fig. 5. Different types of dust extractor hoods used on carburetted water gas plants. Left (a): Centriflovane grit catcher. Centre (b): Cyclone dust extractor. Right (c): Howden up-flow dust collector.

gases should contain less than .4 grains per cu.ft. with .15 grains under 20 μ in size.

At Sydenham the recovered dust and grit was returned to breeze burning boilers for steam raising, the returned materials having an ash content of 17% and a calorific value of 12,000 B.t.u. per lb. Another possibility of dealing with the collected dust is to mix or blend it with coal of high caking power which would have a beneficial effect on coking conditions and on coke quality.

The successful development of dry-sealed water-gas generators has enabled blast pressures to be increased to about 50 in. w.g., and in exploiting the benefits of these high outputs new dust problems begin to assert themselves. A good account of these measures to eliminate dust at various stages in water gas production was contained in a paper read to the London and Southern Section in 1957 by Dr. E. Spivey and Mr. C. H. Williamson[5] in which they gave an account of production of water gas in new plants at Beckton. Mechanically vibrated screens were incorporated in the coke supply arrangements to the generator so that the coke actually reaching the generator would be free from smalls below 1 in. The main connecting the generator to the carburettor was in the form of a long loop and facilities were installed for adjustable blades to skim off the dust and grits hugging the outside faces of the bend. This principle of earliest separation of solids carried over from the generator is sound not only because it facilitates the removal at a final stage, but also because it keeps the washbox clean. Unfortunately this particular attempt failed because of the blocking of the solid offtake parts and abrasion of the lining. It would be interesting to learn if a further attempt has been made.

Cyclones (as Fig. 5b) were incorporated to remove grit and dust as a final stage below the stack valve and operated with an efficiency of 86-89% depending on the blast rate. The hot dust from the post-generator collecting system and the dust and grit from the stack arrestor were recovered wet by an ingenious disposal system which avoids secondary dust evolution on further handling.

Grit Arrestor Abandoned

Some interesting figures were quoted of the variation in the amount of dust and grit collected with different rates of blowing. As the rate of blowing increased from 19,400 cu.ft. per minute to 24,100 cu.ft. per minute the total dust collected varied from .30 lb. per 1,000 cu.ft. of c.w.g. to .82 lb., which clearly illustrates the need for greater attention to be paid to grit removal when operating at high blast rates. Most of the dust collected was caught in the cyclone catcher and only about one-fifth of it in the post-generator dust eliminator. The total dust collected per day from four sets in this plant amounted to 10 tons which would otherwise have been spread over the neighbourhood. At these high blast rates sometimes lumps as large as 3 in. in diameter were carried forward. It was disappointing that the post-generator grit arrestor had to be abandoned because the shave-off apertures became blocked with lumps of coke too large to pass through and that the refractory linings round the inlets broke down owing to the very severe gas conditions at this point.

The plant was soon followed by another large scale carburetted water gas plant which incorporated upward-flow chequerless carburettors with tangential blow gas inlets allowing gas leaving the generator to be degritted and de-dusted at the base of the carburettor. Here dust and grit were collected with an efficiency of up to 66% and means were provided for their continuous removal.

Before the waste gases reach the stack boilers they pass through a Howden vortex (Fig. 5c). About 10% of the material collected was dust (below 74 microns) and of that leaving 89% was below 58 microns. The efficiency of the vortex was between 49 and 66%, but was dealing with a very fine material. Lest the conclusion drawn from these figures should seem oversimplified, the authors showed that if the vortex had had to deal with the same dust as that entering the cyclones, the efficiency would have been 81% as compared with 86% for cyclones. The first stage removal in the carburettor itself, makes a valuable contribution to overall dust removal.

Effectiveness of Measures

The majority of grit arrestors fitted to water gas plants are of the Centriflovane type (Fig. 5a), and Mr. S. K. Hawthorn[6] of Birmingham reports an improved performance of some of these situated near to sensitive neighbours by fitting an encircling vertical cylinder of aluminium opposite the gas outlet of the arrestor. This device arrests a substantial portion of the remaining solids which are flushed down into a drainage system. It is the grit and dust which finally emerges which should be the criterion of good performance and not the efficiency of removal. A grit arrestor slipping 16% is only half as effective as one slipping 8%. The effectiveness of the measures which can be taken on water gas plants even at high blast rates is encourgaing.

During the last decade cyclic catalytic oil gasification processes have been introduced into, and developed in, this country. The first plants were small, and although they depended on the combustion of fuel oil of 3.5% sulphur, their influence on atmospheric pollution was insignificant. There was no problem of dust and grit emission, but sulphur dioxide was recognised as undesirable pollution, particularly later since many plants were beginning to be built and some of them at a capacity as high as 4 mill. cu.ft. per day. It was at this stage that the Chief Alkali Inspector decided to regard these plants as paraffin oil works . . . . 'in which any product of the refining of . . . . crude petroleum is heated so as to cause the evolution of gases containing any sulphur compound.'

It was conceded that the only reasonable method of disposing of the SO_2 was by dispersion from a chimney and for this purpose a chimney needs to be of sufficient height to be free from downdraught induced by neighbouring buildings and hills, with a diameter to ensure sufficient velocity of emergence of the chimney gases to escape downwash caused by eddies on the lee side and of sufficient height to avoid unacceptable concentration of chimney gas constituents at ground level.

The Industrial Sub-Committee of the Beaver Committee took all this into account and while admitting that further research was necessary on this subject, submitted that a good working rule for a chimney adjacent to low buildings was that it should be not less

than 120 ft. high, subject to exercise of discretion for small installations.

The graph (Fig. 6) shows the criteria used by the Alkali Inspectorate when giving decisions on chimney height, and three examples are shown on it. This chart is becoming widely known, but it is sometimes erroneously regarded as being limited to oil gasification plants; it is equally applicable to new installations of other gas-making plants. A recent case has arisen of a standby c.w.g. plant to be built to cover the gas load during resetting in the Isle of Wight. The SO_2 was calculated to be .2 tons per day from the combustion of coke. This was submitted to the Alkali Inspector with a plea that 120 ft. high would be an expensive structure for a standby plant, that the process was cyclic and therefore the velocity of emergence was at least doubled, that there was no waste heat boiler and therefore the thermal uplift would increase the effective height of the chimney and the coke used was of lower than average sulphur content. These factors were taken into account and the chimney will be 50 ft. high.

When these decisions were being taken plants were already in existence with lower chimneys than 120 ft.; construction was taking place on others and some of the least advanced were required to re-design their chimneys.

Increasing the height of chimneys brings problems of ground space where the layout is already tight, problems of maintenance and accessibility, and these have been solved in various ways. It can be imagined that some of these chimneys will be so high that æsthetic objection will be raised against them, but objections would be dealt with by the Minister of Housing and Local Government, who is responsible also for the Alkali Inspectorate. At Southampton works, the 220 ft. chimney just built is regarded as a dangerous obstacle to aircraft using Eastleigh Airport and seaplanes using Southampton Water. At Board's expense warning lights have been fitted in three positions at 105 ft. high and three positions at 210 ft. high. Each position is backed up by three lamps in reserve and the reserves automatically come into action on lamp failure. This is to economise in the number of ascents of the chimney.

No Evidence of Increased Pollution

This chimney is used for two 4 mill. cu.ft. per day catalytic oil gasification plants using for one month a year 950-second fuel oil and refinery gas during the rest of the year. It only needed to be 155 ft. high to serve the two sets, but adjacent space had been left for building two more sets. It would not have been acceptable to build another chimney 155 ft. high because the chimneys would have been so near together that their effect on ground level concentration of SO_2 would have been unsatisfactory. The decision would then have to be made to extend the height of the first chimney to 220 ft. and putting the whole plant out of action during this period of modification. Instead it was deemed prudent to build the chimney to the height appropriate for future extensions and for the use of fuel oil of high sulphur content. The chimney cost £16,000 including £900 for aircraft warning lights.

The emission of SO_2 from the 110 ft. high chimney

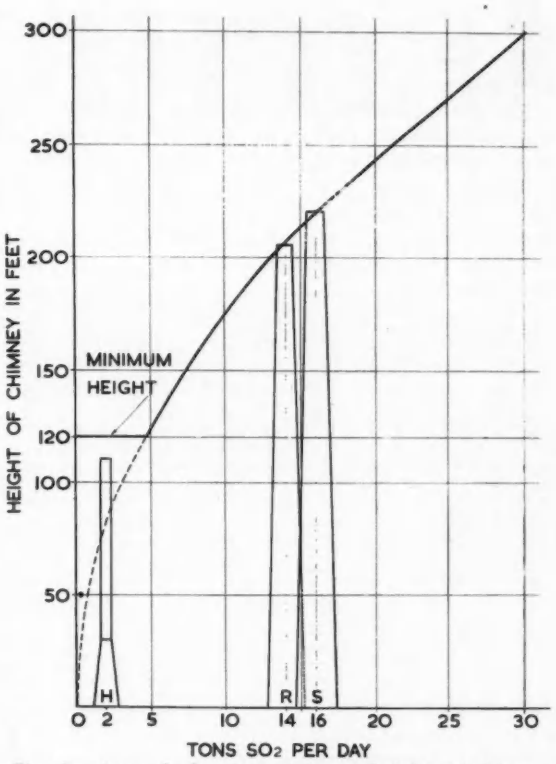

Fig. 6. A graph showing minimum heights of chimneys necessary for gas making plants, for different potential sulphur dioxide pollution into works' atmospheres.

of the 2 mill. cu.ft. per day catalytic oil gasification plant at Portsmouth has been studied during 1957 by the city analyst at four test stations 30 ft. high and surrounding the works at a distance of half a mile. The periods of plant operation were reported to the analyst to enable him to seek correlation with his tests. The analyst reports that 'the results show that at the height tested there is no evidence of increased pollution from sulphur dioxide due to the new gas from oil plant.

'Observations of atmospheric sulphur dioxide and smoke are made at over 100 testing stations in various parts of the country, and a report from the Department of Scientific and Industrial Research permits a comparison of the Portsmouth atmosphere with that of high, medium and low contaminated areas. Table 4 gives

TABLE 4

	Daily average smoke. Mgm. per 100 cu.m.			Daily average sulphur dioxide. Parts per 100 mill.		
	Summer	Winter	Year	Summer	Winter	Year
National results						
High	31	81	56	10	19	14
Average	12	32	22	5	11	9
Low	1	3	3	2	3	3
Portsmouth results						
Copnor	8	38	23	1	5	3
North End ..	7	34	20	1	5	3
Hilsea	5	34	19	1	5	3
Farlington ..	5	34	19	1	5	3

this comparison; the D.S.I.R. figures apply for the year ending March 31, 1956, the Portsmouth figures for the year ending March 31, 1958.'

The sulphur dioxide in the Portsmouth atmosphere is low and compares favourably with the least contaminated areas in the country.

Since the survey, this oil gasification plant has been operated on virgin naphtha and the sulphur emission can fall from 832 lb. per mill. cu.ft. down to 2 lb. per mill. cu.ft. when virgin naphtha is used on the blow. (See Table 5.)

TABLE 5
Basis—1 mill. cu. ft. 500 c.v. gas from Catalytic plant

	Using medium fuel oil Lb. of sulphur	Using light virgin naphtha Lb. of sulphur
Sulphur in		
Medium fuel oil 4,000 gal. ..	1,330	
Light virgin naphtha 4,500 gal.		16
Sulphur out		
Spent oxide	429	7
To atmosphere	832	2
Tar	33	—
Purified gas	36	7
Total	1,330	16

In earlier references to plant operation only coal charging and coke discharging were considered, but pipe cleaning, in extreme cases by burning, leads to short periods of smoke emission in all types of carbonising plant.

Continuous vertical retorts require to be run out for scurfing and when the gas being evolved is unacceptable it is discharged to atmosphere until the retort is empty. It is then usual for scurfing hoods to be fitted and controlled combustion of scurf follows. These scurfing operations, when carried out as a regular routine, make but little difference to air conditions, but when they are concentrated during weekends or Bank Holidays to cause a substantial fall in gas production, the problem is intensified.

Retort maintenance in a tight condition has been facilitated by various methods of hot repairs by 'welding' and by airborne powder sealing. These reduce gas leakage which can lead to smoke appearance in extreme cases. When starting up gasification plant from cold or from lower than working temperature, smoke emission cannot be avoided. The occasional burning off of carbon deposits from catalysts involves appearances of smoke. During short periods in each cycle, smoke from back stacks of three shell gasification plants appears. All these emissions do not necessarily reach the standard of dark smoke and the best practicable means are taken of minimising these emissions.

During the last few years it has been realised that there was more to be gained economically by co-ordination of steam and power than by the asymptopic approach to the ceiling of carbonising efficiency. At the same time the degree of mechanisation has been increased. In spite of this the generation of steam, particularly direct fired steam, has tended to decrease. The fundamental basis is to determine first how much low pressure steam is needed for process purposes, then to decide how much of this can be met by passing high pressure waste heat boiler steam through prime movers for power, air blowing, gas pumping, etc. Only if this high pressure steam does not suffice should the deficit be made up by direct fired steam.

Such a review shows that there is often little or no scope left for direct fired boilers, but of those which survive in the gas industry, none is using any but smokeless fuels apart from lighting up. Fewer and fewer remain which are hand charged. With coke or breeze, however, there is not the risk of smoke emission associated with the hand firing of fuels with a greater volatile content, which is giving so much concern to the small factories operating coal-fired, hand-charged Lancashire boilers. The gas industry chooses coke breeze for its fuel for direct fired boilers, and chain grate stokers vary from those adapted for use in Lancashire boilers generating 4,000 lb. steam per hour up to those fitted to water-tube boilers of 30,000 lb. per hour.

The dust collected in cyclone separators fitted to such plants amounts to about 1% of the fuel burnt. These chain grate stokers are normally started up on coal when smoke emission may occur, and during soot blowing operations to clean the water tubes smoke cannot be avoided.

Mr. S. K. Hawthorn[6] reports that the waste gases from a battery of breeze burning boilers in a sensitive neighbourhood were not satisfactorily cleaned by cyclones. Five wet washers were installed and the gases passed through them in parallel with complete success, except that corrosion was severe in spite of dosing with sludge from water softening plant. The washers were later constructed of teak with glazed earthenware fittings. In another installation dust extraction from a breeze burning installation was satisfactorily carried out by using cellular dust collectors followed by cyclones.

Lancashire boilers released from full-time duties by better co-ordination of steam and power, are often brought into use for seasonal, peak load or emergency production, but to obtain the necessary flexibility, quick availability and output, they are often converted to use oil tar, coal tar, C.T.F. 200 or fuel oil. Consistently dry tar, preferably preheated, is necessary to avoid slugs of very wet tar (above 10% water content) putting out the burner. Varying moisture content also affects burner adjustment and causes smoke to be emitted. In such boilers it is wise to install photoelectric cell smoke indicating or recording instruments.

None of the dust recovered by these recovery methods has any economic value. Many of the devices cause back pressures of the order of 2 in. w.g. and in a number of processes power costs may be appreciably increased. Cleaner gasworks atmospheres undoubtedly lead to reduced corrosion and cheaper maintenance, but the advantage is not easy to evaluate.

Germanic oxide is about the only example where the material is valuable, but this dust is normally recovered from cold settings and not during operation.

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